Example of Information for Baseline & Supplemental Projects

American Municipal Power  December 14, 2017
Baseline Project: Description of Project

Problem Statement: PJM/NERC/TO Criteria violation and description

Criteria Violated: NERC or PJM or TO
- List of all criteria violations, contingencies
- Description of facilities
- Dates of previous reviews
- Detailed list of all questions and To responses to question initiated at the TEAC or SRTEP meetings.

Proposed Solution:
- Describe proposed solution presented for the first review of the violation.
- Provide the following details for line projects:
  - Current & Proposed line ratings: [Normal MVA, Emergency MVA]
  - Current & Proposed line conductor rating: [Normal MVA, Emergency MVA]
  - Impacted line loadings (%): before and after projects IsD using worst flowgate loading on transmission system.
  - Provide normal MVA, emergency MVA loading for new and/or impacted lines associated with the project
    - In-service loading: XX% [best guess on date if no firm date for first review]
    - 10 year loading: XX% [same here, best guess if firm date is not known]
  - Loading % “Deltas” changes on ALL facilities impacted by project.
  - Delta Loading Increase = MVA after projects – MVA before project
  - Delta Loading Decrease = MVA before project – MVA after project
  - Asset Class: Identify if overloaded facility is distribution or transmission based upon current owners accounting records, Identify if upgraded facility is distribution or transmission, Identify if solution is a transmission or distribution solution.

Estimated Project Cost: $XX.X M [only show transmission costs and descriptions that will be paid for under FERC rate]

Alternative Solutions:
- Description of Alternatives. Include a description of all options that can solve this type of problem such as a new line, line upgrade, capacitor bank, then let us know why these solutions were eliminated and the details on the feasibility & cost
- Provide line ratings, conductor and both loadings as above.

Estimated Project Cost: $XX M (Estimate Class, Class 1-5)

Projected IS Date Submitted by Designated Entity or Transmission Owner: XXXXXXXX

Required IS Date Identified by PJM: XX/XXX/XXXX

PJM Determined Project Status: Conceptual, Engineering, Under Construction, Completed or whatever the categories are.

Associated Projects: list any other approved or proposed connected with these facilities or nearby (same line)
Supplemental Project:

Problem Statement: Operational Performance/Reliability/Risk etc. Value used to determine
Criteria Violated: Local Utility Planning Guide reference, detailed description of primary driver's for project, detailed
description of all other project drivers

Date Project Presented Previously at: XX/XX/XXXX Southern/Mid-Atlantic/Western RTEP

- Description of Project, ratings current and new, conductors, equipment, any contingency loadings or in-service loadings for
  lines and transformers.
- Any comments, data requests, or action items resulting from first review of project at stakeholder meetings

Recommended Solution:
Description of solution and justification and decisions made by TO to determine this solution. Whether we use Potential
Solution or Recommended Solution is up for discussion. Guess it would be Potential for first review, Recommended for
second or other review.

Alternatives: Description or None. Include a
description of all options that can solve this type of
problem such as a new line, line upgrade, capacitor
bank, then let us know why some of these were
eliminated and the details of the feasible solutions,
include cost break down, and one-line diagrams of
alternative proposal.

Estimated Project Cost: $XX M

Projected IS Date: XX/XX/XXXX

Project Status: Current status options.

Associated Projects: list any other approved or proposed connected with these facilities or nearby (same line), list of any other
assets or facilities in the sounding? and their rehab/condition/performance/risk issues

Show current and proposed substation one
lines so stakeholders can understand the reasoning
behind the need for the re-design. Show substation
location on TO map and
PJM location map as
typical. Show legend as
needed to understand one-
lines.
Transmission Owner, PJM region, Zone, Area,

Project Title

Problem Statement
Transmission Owner or Designated entity
Supplemental/TO Baseline/ PJM Baseline
Zone (Southern/Mid-Atlantic/Western, TEAC)
Date Project Was Previously Presented
Primary Project Driver (Description)

Description of impacted facilities
Description of load delivery points served by impacted facilities and their ownership
Drivers Accounting Class (Distribution, Transmission)
Proposal Cost
Proposal Need Date
Proposal Targeted In-service Date

“Individual” Stakeholder Comments

Organization Date Documented Response

Power Flow Criteria

Bus, Branch, Facility, Equipment in Violation and/or Driver (PSSE bus Number, Branch Identifier)
Contingency or Contingency Causing violation
PJM’s Verification of TO results

Justification Driver

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Probability of Failure Description</th>
<th>Impact of Failure Description</th>
<th>Risk of Failure Description</th>
<th>Criticality Measure</th>
<th>Equipment Health Value</th>
<th>Historical Reliability Impacts</th>
<th>Historical Performance Measure</th>
<th>Maintenance (O&amp;M)</th>
<th>Spare Part Availability, Software Compatibility, Vendor Support (Description)</th>
<th>Environmental and/or Safety Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Threshold</td>
<td>P(x)</td>
<td>(1 - P(x))</td>
<td>(1 - P(x)) * (1 - Q(x))</td>
<td>M(x)</td>
<td>H(x)</td>
<td>CMI, CI, SAI, SAIDI, CAIDI, Loss of Load</td>
<td>List of Outages: Momentary Outage, Initiating Cause, Sustained Cause, Data Outage, Permanent Outage, Initiating Cause, Sustained Cause, Date, Duration System Averages (T-SAI, T-SAIDI, T-SAIDI-S, T-MAIFI)</td>
<td>Maintenance Completed and Cost Maintenance Findings and Estimated Cost</td>
<td>Spares in inventory Number of similar assets on system</td>
<td>Description of issue Number of these issues on the system</td>
</tr>
</tbody>
</table>

Add detailed map:
- facilities mentioned for project with locational PJM map as shown.
- Facilities mentioned for project alternatives
- MW, MVAR flows & PU voltages for each facility in diagram
- If alternative is not feasible based on powerflow violation, depict MW, MVAR flows, PU voltage violation with Flow gate, and description of overload.
### Transmission Owner, PJM region, Zone, Area,

#### Description of Proposed Solution
- **Description of Proposed Project and Reasoning for Selecting Solution**
- **Component Description**
- **Estimated Component Cost**
- **Component In-Service Date**

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
<th>Cost</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basement 1</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Basement 2</td>
<td>N/A</td>
<td>N/A</td>
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</table>

- **Was Retirement Considered Why or Why not?**
- **Was rebuild considered: Why or Why not**

#### Proposed Facility Details
- **Current Overloaded Line’s Rate “A” Normal (MVA), Rate “B” Emergency (MVA)**
  - Rate A
  - Rate B
- **Proposed” Line’s Rate “A” Normal (MVA), Rate “B” Emergency (MVA)**
  - Rate A
  - Rate B

#### Proposed & Impacted Facilities Analysis
- **Proposed Site’s “N” Loading System Normal (N=0)**
- **Proposed Site’s “N” Loading System Normal (N=0)**

<table>
<thead>
<tr>
<th>Description</th>
<th>Loading % Rate A</th>
<th>Loading % Rate B</th>
</tr>
</thead>
<tbody>
<tr>
<td>N/A</td>
<td>N/A</td>
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#### Analysis For: 5 Year Forward

- **Proposed Facility**
  - N-1 Thermal Overload
  - Generation Deliverability Thermal Overload
  - Load Deliverability Thermal Overload
  - N-1-1 Thermal Overload
  - N-1 Voltage Drop
  - N-1 Voltage Magnitude
  - N-1-1 Voltage Magnitude
  - Any TO specific analysis and criteria

<table>
<thead>
<tr>
<th>Facility Name, To Bus, From Bus, ID</th>
<th>N-1 Thermal Overload</th>
<th>Generation Deliverability Thermal Overload</th>
<th>Load Deliverability Thermal Overload</th>
<th>N-1-1 Thermal Overload</th>
<th>N-1 Voltage Drop</th>
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</table>

- **Impacted Facilities**
  - Proposed Line’s/Station’s highest “%” loading, lowest voltage, or largest voltage deviation for all study scenarios

- **Existing Line’s & Transformers with “%” Changes greater than – 40% for (N=0)**
- **Existing Line’s & Transformers crossing the 80% loading threshold for (N=0)**
- **Existing Line’s & Transformers crossing the 80% loading threshold for all study scenarios**
- **Existing Line’s & Transformers crossing the 80% loading threshold for all study scenarios**
- **Existing station’s PU change of more than 2%, or within 2% of TO criteria threshold**

- **N/A for all none applicable fields**

**Request Same Detail Above for Alternative Project Review**

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12/14/2017 Baseline and SupplementalProjects 5
Transmission Owner, PJM region, Zone, Area,

Station Performance Driven Projects
Transmission Owner, PJM region, Zone, Area,

**Performance Driven Projects Stations:**

- Number of Forced Permanent Outage
  - Causes of each outage (Initiating cause and sustained cause)
  - Duration of each outage
- Number of Momentary Outages
  - Causes of each outage (Initiating cause)
- List of the Equipment Outages caused by each event
- Individual event details including number of customers impacted (CI) by each event
- Amount of recorded customer minutes of interruption (CMI) for each event
- Amount of load impacted by each event
- Amount of consequential generation loss due to outage (Generation served by the station)
- Event date & event time
- Calculated System (All voltage classes & each kV class) Average Availability Rate for, Assets Availability Rate
- System (All voltage classes & each kV class) Average values (TSAIDI, TSAIFI, TMAIFI, TSAIFI-S, IEEE SAIDI, IEEE SAIFI, IEEE CAIDI, Number of customers used to calculate SAIDI,SAIFI,CAIDI)
  - Reference:[http://www.pjm.com/~media/committees-groups/committees/srrtep-w/20170124/20170124-aep-transmission-owner-needs-guidelines.ashx](http://www.pjm.com/~media/committees-groups/committees/srrtep-w/20170124/20170124-aep-transmission-owner-needs-guidelines.ashx)
- Station’s performance ranking and overall ranking relative to all other stations in system
- Any and all other referenced inputs including but not limited to: Table #1 and Table #2
- Detailed description of how TO applies the data noted above, or any other data not included to determine EOL

*For each item listed use multiple sheets or (.xls) spreadsheet if required*
Transmission Owner, PJM region, Zone, Area,

Station and Station Asset Condition Driven Projects

http://assets.fiercemarkets.net/public/smartgridnews/End_to_end_asset_health.pdf
https://www.satcs.co.za/Transformer_Oil_Analysis.pdf
Transmission Owner, PJM region, Zone, Area,

Station Condition Inspection Details: Station & Station Structures

- Date of last inspection
- Date condition was first identified and action taken when identified
- List of conditions identified (example: cracked foundations, rusted steel, damaged conductor terminations, missing grounds, broken insulators, cap-N-pin insulators, damaged capacitor cans, flooding/drainage issues)
  - Foundation conditions, number of foundation conditions and severity of conditions
  - Structural conditions, number of conditions, and severity of conditions (rusted, bent, rotten, cracked, split)
  - Grounding conditions, number of conditions, and severity of conditions
  - Insulation conditions, number of conditions, and severity of conditions (insulation type, crack, broken, deteriorated, failed)
- List of operational constraints associated with station
  - Abnormal conditions, date first identified
  - Known failed/Un-operable equipment, date first identified
  - Non-Functioning equipment, date first identified
  - Non-standard Electrical configurations, date configurations was installed
  - Site constraints (clearance issues, drive island concerns, known flooding issues, site access)
- List of safety issues at station
- Station obsolesce items
- Station vandalism reports (stolen grounds, break-ins, gun shots, etc.)
- Station ground assessment details.
- Station shielding
- Telecommunication, RTU needs (Mode of communications, bandwidth, fiber, cable, RTU type and maker, channel available, channels used, RTU install date)
- Relaying needs (relay type, electromechanical, static, microprocessor)
- List of all known conditions at a station and the station’s relative condition ranking to all station on the system

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http://assets.fiercemarkets.net/public/smartgridnews/End_to_end_asset_health.pdf
Transmission Owner, PJM region, Zone, Area,

**Condition Driven Projects: Station Equipment “Transformers, Series & Shunt Reactors”**

- **Transformers** (Values if used to assess transformers health or EOL or life expectancy)
  - All recorded test dates and their corresponding data listed below:
  - Date when recorded data first exceeded TO thresholds, action taken prior or date threshold exceeded
  - Past electrical test results if conducted
  - Core ground test result
  - Total combustible gas
  - Gas concentration levels and trending, (IEC 567)
    - Hydrogen (H2) ppm, system average ppm
    - Methane (CH4) ppm, system average ppm
    - Ethane (C2H6) ppm, system average ppm
    - Ethylene (C2H4) ppm, system average ppm
    - Acetylene (C2H2) ppm, system average ppm
    - Carbon Monoxide (CO) ppm, system average ppm
    - Carbon Dioxide (CO2) ppm, system average ppm
  - Water concentration levels and trending (IEC 814)
  - Oil Dielectric Strength and trending (IEC 156)
  - Oil Acidity or Neutralization Numbers and trends (ATSM D971)
  - Interfacial Tension and trends (ASTM D971)
  - Calculated Likelihood of failure, risk of failure, and asset criticality, system averages for each of previously stated items
  - Health score and/or replacement score and/or remaining useful life
  - Recommend solutions and timelines provided by assessment software
  - Asset Age
  - O&M tasks completed on unit, date completed

*For each item listed use multiple sheets or (.xls) spreadsheet if required

http://assets.fiercemarkets.net/public/smartgridnews/End_to_end_asset_health.pdf
Condition Driven Projects: Station Equipment “Circuit Breakers”

- Breaker “Accessories”
  - Function of cabinet, mechanism, and tank heaters
  - Number of hydraulic pump starts
  - Total accumulated run hours of the air compressor
  - Total accumulated run hours of the SF6 compressor

- Breaker “Dielectric”
  - Insulating oil dielectric strength
  - Rated voltage vs. applied voltage
  - Rated current vs. applied current
  - SF6, or oil moisture content, pressure, and purity
  - High-pressure SF6 moisture content, pressure, and purity
  - SF6 Density

- Breaker “Mechanical”
  - Closing time, velocity and acceptable limits
  - Trip time, velocity, trip coil currents and acceptable limits
  - Interpole close time, trip time deltas and acceptable limits
  - Resistor preinsertion time and acceptable limits
  - Total interrupter travel and acceptable limits

- Breaker “Wear”
  - Contact wear (switch operations) and acceptable limits
  - Main nozzle wear and acceptable limits
  - Auxiliary nozzle wear and acceptable limits
  - Contact resistance and acceptable levels
  - Interrupter wear and acceptable levels

- Breaker “Other”
  - Mechanism stored energy state
  - Motor current and run time
  - Time elapsed since last inspection, maintenance and overhaul
  - Breaker age
  - Breaker test or switch operations and acceptable limits
  - Breaker event operations “fault” interruptions
  - Breaker nameplate arc times

- Additional Values if used to make replacement decision
  - Risk of Failure and acceptable levels
  - Asset Criticality Values
  - Probability of failure and acceptable levels
  - Replacement score and maintenance score
  - Asset Health score, Remaining useful life
  - Forecasted Maintenance
  - Priority of asset replacement
  - List of all circuit breakers and their associated scores and rankings

*For each item listed use multiple sheets or (.xls) spreadsheet if required
Transmission Owner, PJM region, Zone, Area,

**Risk Driven Projects: Stations**

- **Transmission Lines or Substation**
  - (Values if used to assess transmission lines risk, EOL or life expectancy, only if used in TO’s assessment)
  - Calculated probability of failure with detailed inputs
  - Associated impact values used to calculate risk
    - Customers impacted
    - Load Impacted
    - System impacts
    - Generation Impacts (Per Planning Model)
    - Expected energy not delivered
    - Dynamic reactive devices impacted and their MVA
    - Number of stations with voltage sags
    - Number of tie line interconnections interrupted
    - Arming of SPS scheme’s due to stability or thermal constraints
    - Number of real time operational constraints resulting in load drop warnings
    - Any impacts not listed above
  - List of all stations and their associated Risk scores and risk rankings

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Transmission Owner, PJM region, Zone, Area,

Transmission Line
Rehab Driven Projects
Transmission Owner, PJM region, Zone, Area,

Performance Driven Projects Transmission Lines:
- Number of Forced Permanent Outage
  - Causes of each outage (Initiating cause and sustained cause)
  - Duration of each outage
- Number of Momentary Outages
  - Causes of each outage (Initiating cause)
  - List of the Equipment Outages caused by each event
- Individual event details including number of customers impacted (CI) by each event
- Amount of recorded customer minutes of interruption (CMI) for each event
- Amount of load impacted by each event
- Amount of generation impacted
- Event date & event time
- Calculated System (All voltage classes & each kV class) Average Availability Rate for, Assets Availability Rate
- System (All voltage classes & each kV class) Average values (TSAIDI, TSAIFI, TMAIFI, TSAIFI-S, IEEE SAIDI, IEEE SAIFI, IEEE CAIDI, Number of customers used to calculate SAIDI,SAIFI,CAIDI)
  - Reference: http://www.pjm.com/~/media/committees-groups/committees/srrtep-w/20170124/20170124-aep-transmission-owner-needs-guidelines.ashx
- Tline’s performance ranking and overall ranking relative to all other Tlines in system
- Any and all other referenced inputs including but not limited to: Table #1 and Table 2

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Transmission Owner, PJM region, Zone, Area,

**Condition Driven Projects: Transmission Lines**

- Date maintenance was last perform (per structure basis, and on entire asset)
- Asset Age
  - List of each structure’s age associated
  - Total count of all structure
  - Conductor used on each span and conductor age
  - Identified data gaps and/or missing data
- Asset Design
  - Material comprising structure (Steel, Aluminum, Wood, Concrete, Composite, Underground)
  - Structure design (Monopole, H frame, Lattice)
  - Cross arm material (Wood, Steel: if applicable)
  - Insulators (Glass, Porcelain, composite)
  - Shielding features of each structure (Double/single shield wire, OPGW, structure grounded Y/N)
  - Grounding status of each structure and ground resistance
- Condition List
  - Detailed description of each condition including component and condition
  - structure or span associated with each condition
  - geographic location of condition
  - severity of condition, date that condition was first identified, date of last inspection
  - Any additional known defects with structure design or components comprising structure
- Asset’s condition ranking and asset’s ranking overall as compared to the all other T-line in the system

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[http://assets.fiercemarkets.net/public/smartgridnews/End_to_end_asset_health.pdf](http://assets.fiercemarkets.net/public/smartgridnews/End_to_end_asset_health.pdf)
Risk Driven Projects: Transmission Line and Stations

- Transmission Lines or Substation
  - Calculated probability of failure with detailed inputs
  - Associated impact values used to calculate risk
    - Customers impacted
    - Load Impacted
    - System impacts
    - Generation Impacts
    - Expected energy not delivered
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    - Arming of SPS scheme's due to stability or thermal constraints
    - Number of real time operational constraints resulting in load drop warnings
    - Any impacts not listed above
  - List of all stations or tines and their associated Risk scores and risk rankings

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